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UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY WASHINGTON, D.C. 20242

Technical Letter NASA-17 August 1966

Dr. Peter C. Badgley Chief, Natural Resources Program Office of Space Science and Application Code SAR, NASA Headquarters Washington, D.C. 20546

Dear Peter:

Transmitted herewith are 2 copies of:

TECHNICAL LETTER NASA-17

EVALUATION OF EKTACHROME AND MULTIBAND PHOTOGRAPHY

IN CALIENTE RANGE, CALIFORNIA*

by

J. G. Vedder and E. W. Wolfe**

Sincerely yours,

William A. Fischer Research Coordinator Earth Orbiter Program

*Work performed under NASA Contract No. R-09-020-015

**U.S. Geological Survey, Menlo Park, California

UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

TECHNICAL LETTER NASA-17

EVALUATION OF EKTACHROME AND MULTIBAND PHOTOGRAPHY

IN CALIENTE RANGE, CALIFORNIA*

by

J. G. Vedder and E. W. Wolfe**

August 1966

These data are preliminary and should not be quoted without permission

Prepared by the Geological Survey for the National Aeronautics and Space Administration (NASA)

*Work performed under NASA Contract No. R-09-020-015 **U.S. Geological Survey, Menlo Park, California

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EVALUATION OF ENTACHRONE AND NUMBER BAND PHOTOGRAPHY IN CALIENTE RANGE, CALIFORNIA

by

J. G. Vedder and E. W. Welfe
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An area in the Caliente Range of southern California, secs. 17, 18, 19, T11N, R21E, was selected for a trial of aerial Ektachrome and multiband photography. One test area which is approximately a mile square, is underlain by a northeast-dipping homoclinal sequence of Tertiary marine and nonmarine sedimentary rocks and basalt. Good exposure and detailed geologic mapping (Vedder and Repenning, 1965) make the area particularly well suited for study. The flight was made on a November afternoon, and deep shadow obscures geologic features in the more rugged parts of the area.

Features particularly striking in the multiband image include the following:

- (1) White to pale "salmon" arkosic sandstone beds in unit ${\rm Tc}_3$ and resistant white sandstone beds in unit ${\rm Tbc}$ show up in the multiband composite as well defined red zones. The sandstone beds, especially those in the western part of the area, are much less obvious in the Ektachrome image.
- (2) Similar red zones occur on the floors of some canyons southwest of the "Main" basalt (Tb₅). Frobably they reflect the occurrence of alluvial white sand on the canyon floors. At best, this feature is barely discernible on the Ektachrome.

(3) Although striking on the Ektachrome image, the "Main" basalt (Tb₅) is one of the most obvious features of the multiband image, where it is represented by a purplish northwest-trending band sharply bounded to the southwest and northeast. The southwest contact, well defined on the Ektachrome, and even more vividly defined on the multiband image is the hasal contact of the basalt. The northeast boundary of the purplish band lies stratigraphically below the top of the basalt; it defines the ridge crest and, perhaps only coincidentally, the contact between exposed basalt in place and basalt talus on the northeast-facing dip slope.

Features with equivalent definition in the two images include the following:

- (1) Bedding in several of the sedimentary units such as Tm, Tcs, and Tc_3 is well defined.
- (2) Talus from the "Main" basalt (${\rm Tb}_5$) is clearly displayed of the slope southwest of the basalt.
 - (3) Contacts of unit Tq are well defined on both images.
- (4) Surficial expression of unit Qoa is equally good in the two images.
 - (5) Unit Tc_5 and the base of unit Tc_4 are obscure in both images.

Features less well defined in multiband image than in aerial Ektachrome include the following:

(1) Distribution of Qya and Q1. Some of the landslide deposits
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near the southeast edge of the area, though well defined on the Ektachrome.

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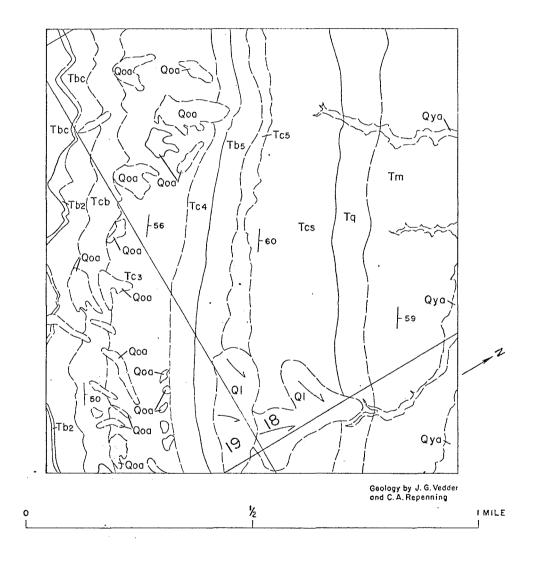
are virtually invisible on the multiband image.

(2) Definition of the drainage pattern is excellent on the Ektachrome and poor in the multiband image, probably because of poor registry in preparation of the multiband composite.

Conclusions:

Aerial Ektachrome photography would be extremely valuable in mapping unknown terrane with color contrast of rock units. However, few rock types could be interpreted without on-site inspection, and for detailed geologic study such photography would greatly aid but not replace on-the-ground geologic mapping.

This trial indicates that multiband methods can be used to discern specific geologic features such as the white sandstone beds of units Tc₃ and Tbc. The implications are that the multiband technique has promise as a remote-sensing analytical tool and that it could be of great value in rapid quantitative analysis of such features as sedimentary facies. Obviously further development of the technique and of our interpretative capability is essential to optimum use of the too.



be, Branch Canyon Formation; medium- to coarse-grained sandstone and pebble-boulder conglomerate, light-gray to yellowish-gray, thick-bedded, locally cross-stratified, concretionary at places; siltstone and fine-grained sandstone, greenish-gray, thin-bedded; claystone, grayish-olive and red, very thin beds locally; dominantly marine; contains shallow-water mollusks

Tb₂, "Triple" basalt of Eaton (1939), middle flow; alkalic olivine basalt, vesicular in part, hydrothermally altered, subaerial

(Stratigraphy from Vedder and Repenning, 1965)

Tcb

Caliente Formation and Branch Canyon Formation of Hill and others (1958) undifferentiated

Tbc

Tb2

Tbc Branch Canyon Formation of Hill and others (1958) and "Triple" basalt of Eaton (1939)

The, Branch Canyon Formation; medium- to coarse-grained

Lithologies of both units intertongued and intricately interbedded; includes very thin tongues of red and greenish-gray to olive-gray mudstone; nonmarine and

Dashed where approximately located

60

Strike and dip of beds

REFERENCES

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Ova

Younger alluvium

Clay, silt, sand, and gravel, unconsolidated, poorly stratified to well stratified; includes alluvial fan, flood-plain, and streambed deposits

Qoa

Older alluvium

Clay, silt, sand, and gravel, unconsolidated to semi-consolidated, poorly stratified to well stratified; includes remnants of streambed deposits, alluvial fans, and flood-plain deposits; dissected and locally



Landslide deposits

Strata disrupted by slumping or block gliding, frag-mented or highly deformed to relatively unbroken; arrows show direction of movement

Morales Formation of Hill and others (1958)

Sandstone and conglomerate, yellowish-gray to greenish-gray, thick-bedded; claystone, greenish-gray, thin-bedded

Τq

Quatal Formation of Hill and others (1958)

Claystone and siltstone, tuffaceous, greenish-gray to yellowish-gray, thin-bedded; gypsiferous; silty very fine grained sandstone in lower part; probably

	_
Tes	
Tc 5	
Tb ₅	
Tc ₄	
Tc3	

Caliente Formation of Hill and others (1958), "Main" basalt of Eaton (1939)

Tcs, claystone, mudstone, siltstone, and fine-grained sandstone, greenish-gray to yellowish-gray and grayish-red, thin-bedded to cross-laminated, ripple-marked; includes biotitic tuff bed; chiefly lacus-

Tc₅, sandstone, conglomeratic, arkosic, clayey, coarse-grained, red to reddish-brown and grayish-red; mudstone and conglomerate interbedded; poorly stratified; nonmarine

Tb_s, "Main" basalt of Eaton (1909), mulery, 31kalic olivine basalt, highly vesicular in part, includes breccias on some flow tops; subaerial "Main" basalt of Eaton (1939), multiple flows;

Tc₄, mudstone, claystone, and sandstone, grayish-red to pale-pink, thin-bedded, nonmarine

Tc₁, sandstone and conglowerate, arkosic, pink to light-red and white, thick-bedded; mudstone, red, thin-bedded; nonmarine; unconformity at base

Piocene

